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Achieving energy efficiency in new hospitals

NHS Estates
An Executive Agency of the Department of Health

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March 1994

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About this publication

A new hospital which has been planned and designed for energy efficiency can have considerably lower energy bills than a similarly sized unit of conventional design. The Department of Health Low Energy Study has demonstrated that this is achievable. The additional investment required to obtain these savings will yield an extremely good return. Designing for energy efficiency is one of the most effective ways of reducing the negative environmental impact of a healthcare estate. Hence, **designing for energy efficiency is both economically and environmentally advantageous** and is important in the planning, design and operation of healthcare premises.

This guide is about:

- the steps which need to be taken to achieve energy efficiency in new hospitals;
- the techniques which can be used to save energy and reduce fuel consumption;
- the financial assessment of energy savings and subsequent optimisation.

Contents

1. **Introduction** *page 3*

2. **Benefits of energy-efficient design** *page 4*

3. **Design process and the business case** *page 5*

4. **Energy-efficient design** *page 6*

5. **Elemental breakdown of energy consumption and energy-saving measures** *page 9*

6. **Selection of energy sources** *page 11*

7. **Finance** *page 12*

8. **Conclusions** *page 13*

9. **Bibliography** *page 14*

About NHS Estates *page 15*

1.0 Introduction

1.1 For a typical acute hospital of conventional design, energy cost per bed is approximately £900 per annum; half of these energy costs are incurred through electricity usage, the remainder through other fuels.

1.2 The energy usage breakdown for the various services within an energy-efficient hospital is shown in Figure 1.

1.3 Two low energy hospitals, St Mary's on the Isle of Wight and Wansbeck in Ashington, Northumberland, were designed and built under the aegis of the Department of Health. The experience from these hospitals and other studies indicates that energy consumption 50% lower than that in a standard designed hospital of similar functional content can be achieved with an energy-efficient design. In the second year of operation, St Mary's Hospital achieved 44% saving in energy consumption. The results of the first year of operation are covered in the document entitled 'Low energy hospitals – St Mary's Hospital, Isle of Wight first year appraisal'.

1.4 The aims of this document are:

a. to quantify and describe the benefits of low energy design;

b. to indicate how energy efficiency can be integrated into the design process;

c. to provide brief detail on the main energy-efficiency measures and quantify the associated savings;

d. to outline the salient points relating to the choice of energy sources;

e. to describe the key points involved in developing a site energy strategy;

f. to outline the necessary financial information required;

g). to provide references enabling further detail to be obtained in key areas.

1.5 General managers and estate managers should be aware of the potential for saving energy, reducing costs and contributing to the Government initiative for reducing negative environmental effects. Project sponsors and managers will find the document particularly useful in the briefing and direction of design teams.

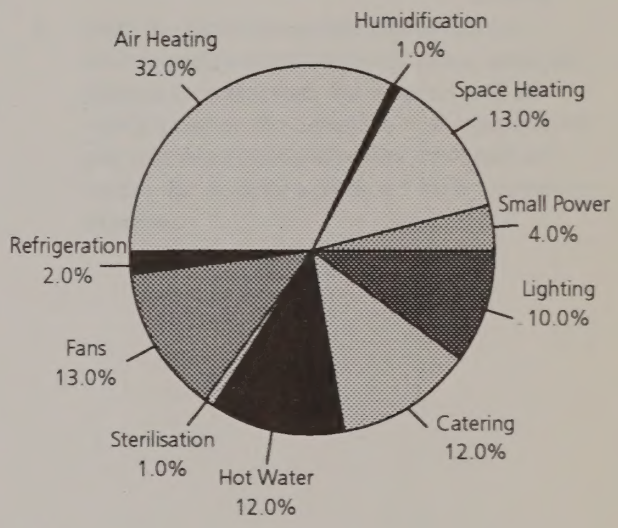

Figure 1 Energy consumption in an energy-efficient hospital

2.0 Benefits of energy-efficient design

2.1 The main benefits of energy-efficient design are:

a. **reduced energy consumption:** there is potential for approximately 50% reduction in energy consumption, about 30% of which can be obtained with no additional capital cost. The remaining 20% can then be obtained from investment which yields a good business return.

   The financial benefits from reduced energy usage can be used to provide "better quality care";

b. **reduced environmental impact:** for a typical 300-bed acute hospital, the 50% energy consumption saving will correspond to reducing the emission of CO_2 by approximately 1500 tonnes per annum;

c. **improved ambient conditions:** an energy-efficient design necessitates maintaining close control of temperature and humidity, resulting in generally improved ambient conditions for patients and staff;

d. **increased equipment lifetime:** in general, systems which are designed for energy-efficient operation will incorporate a high level of control. This results in plant running for the minimum periods of time to satisfy demand, which in turn means that plant overall lifetime is increased. This has the effect of **lowering revenue costs**.

2.2 In order to secure these benefits it is essential that energy efficiency is incorporated into the earliest planning, briefing and design stages and remains a significant consideration throughout the development of a scheme.

3.0 Design process and the business case

3.1 Investment appraisal techniques which have been in wide use throughout the commercial world for many years are now being used to evaluate any submitted investment proposal using public sector finance. This approach can prevent the creation of expensive liabilities and encourage the production of valuable assets.

3.2 There is no point in designing an energy-efficient healthcare facility if there is not a good business case for having the facility in the first place. However, the importance of energy-efficient design, and its impact on both revenue cost and the environment, cannot be underestimated.

3.3 Typically, 2.5% of a total project works costs spent on energy efficiency will yield a good business return. To ensure that return is maximised, the following design process should be followed:

a. analyse the energy demand of the hospital for each service. This will necessitate development of load profiles covering different times of the year and any other major changes in condition;

b. assess the impact of operational policies and develop possible improvements;

c. consider the range of energy conservation measures which can be effected on the building fabric and structure;

d. assess the effects of topography;

e. consider the range of potential energy-saving measures, heat reclaim techniques etc for reducing energy demands;

f. develop a site energy strategy (see Chapter 6) to determine how the hospital energy needs will be supplied;

g. make a detailed cost-benefit analysis to determine the ratios appropriate to each measure being considered (see Chapter 8);

h. select the most appropriate measures from the information produced in (d) above, up to the financial limit allocated. This selection will be mainly based on the benefit-to-cost ratios but will also take into consideration any other relevant factor – for instance a predicted major increase in oil prices.

4.0 Energy-efficient design

4.1 Energy use in a hospital is influenced by a number of factors:

a. topography;

b. the building envelope, plan form and orientation;

c. the services provided;

d. site energy strategy;

e. operational policies and procedures;

f. internal planning of the space;

g. energy management and good housekeeping practices.

4.2 An energy-efficient design will allow the minimum level of energy to be consumed while not compromising the effective operation of the hospital.

4.3 Energy can be reduced by adapting a series of energy-saving measures and heat recovery techniques. The process is shown in Figure 2. Energy efficiency within new hospitals can be improved by the following principles.

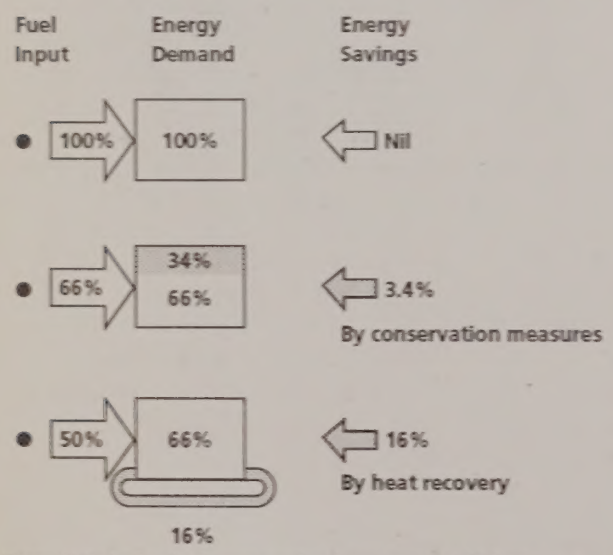

Figure 2 Reducing fuel consumption in an energy-efficient hospital

Topography

4.4 The location of a new hospital on site should receive careful consideration taking advantage of the topology, ground contours and infrastructure.

4.5 Once the site has been selected, the form and position of the hospital on the site will need to take into account energy aspects. In this regard, orientation and shelter will be key factors.

4.6 Siting in combination with built form can, if sensibly arranged, provide micro-climate conditions in and around the hospital which at certain periods can aid the establishment of satisfactory levels of thermal environment and comfort. Air-flow patterns and their role in providing natural ventilation are a prime example.

The building envelope

4.7 Overall thermal properties will be influenced by the requirements of the Building Regulations but it will usually be worthwhile considering higher standards of thermal insulation.

4.8 Double-glazing is not as cost-effective as other energy-saving measures but promotes a better environment by way of reduced noise levels and the avoidance of draughts. It should therefore be considered at the design stage, as retrofitting will be more costly. In areas of high humidity such as ITU, neonatal respiratory care accommodation and operating theatres, double-glazing is an essential requirement to prevent condensation forming on windows.

4.9 A high standard of airtightness is desirable in order to avoid draughts and excessive air change rates through natural ventilation in winter. Infiltration rates of 0.5 air changes per hour and less can be achieved using traditional cladding materials by ensuring good standards of construction and attention to detailing.

Windows

4.10 Windows are the sole means by which perimeter spaces can benefit from daylight and natural ventilation. The following factors are therefore of vital importance.

Size

4.11 This is influenced by the requirements of the Building Regulations; with double-glazing, 35% of the window wall is considered to be the optimum glazed area.

Shape and disposition

4.12 The aim is to achieve an acceptable level of daylight which is uniformly distributed throughout the space. Low- and high-level glazing is necessary; the latter will enable more daylight to reach areas furthest away from the window wall. Roof lights can improve the quality of daylighting but are not favoured because of relatively high capital and revenue costs. There are also undesirable factors to contend with such as solar gain and glare. The performances of various window arrangements can be evaluated with models.

Types

4.13 Overheating often occurs in summer because of poorly designed and installed windows which inhibit natural ventilation. Some types of window are much more effective at promoting natural ventilation than others. Vertical sliding casement types which provide openings that are physically separated from each other are a prime example.

4.14 The size of opening will usually be limited for security reasons. Cross-ventilation within the building is difficult to achieve because of the need for fire safety. Blinds are an important consideration; some effectively reduce natural ventilation by as much as 90%. Vertical adjustable slat-type blinds offer the least resistance.

Plan forming

4.15 A low-rise building is to be preferred. This has a larger footprint, area of roof and therefore heat loss, but there are compensating benefits. Transportation is essentially horizontal and easier, as is ensuring fire safety. The introduction of courtyards will limit the extent of deep planned spaces and will open up areas of accommodation to the availability of daylight and natural ventilation.

Orientation

4.16 Orientation should be such as to minimise heat gains in summer and exposure in winter, and at the same time benefit from solar gain in winter.

Site energy strategy

4.17 The aim of a site energy strategy is:

> **to determine the most cost- and environmentally- effective way of supplying the energy needs of the hospital.**

4.18 Developing the strategy involves integrating the:

- energy-saving measures;
- heat reclaim techniques;
- traditional energy sources;
- natural resources;
- environmental issues;
- future healthcare trends;
- operational policy;
- legislation

to satisfy thermal and electrical demands in the optimum manner. It is essential that the design team assess the relevant combinations in sufficient detail to decide the strategy which is best for the hospital. Failure to do this will impose a cost or functionality burden throughout the life of the hospital.

Developing a site strategy

4.19 The basis for developing a strategy lies in assessment of the energy loads and profiles for the various services and areas of the hospital; identifying diurnal patterns for summer, winter and mid-season. This level of data will be useful in determining the viability of combined heat and power (CHP) schemes and will also determine the extent to which heat recovery can be effectively utilised on the site. Some services, such as catering, can be provided either by electricity or by thermal sources of energy, for example gas. The extent to which this fuel substitution can be economically achieved will also feature in the development of the site energy strategy.

4.20 The second low energy report demonstrates the strategy analysis for Wansbeck Hospital.

4.21 Further guidance can be found in the Health Facilities Note (HFN) series produced by NHS Estates, and particularly in 'Effective heat and power strategies for healthcare premises' (HFN 03).

Operating policies

4.22 These can have a bearing on energy consumption, and therefore merit scrutiny in this respect. For example, if a specific diagnostic room within the radiodiagnostic department is designated for use outside normal hours, this will enable the rest of the accommodation to be shut down at night.

Internal planning

4.23 It is usually not possible to avoid some element of deep planning, yet such spaces need to be artificially lit and sometimes mechanically ventilated as well. Consumption can therefore be minimised if deep planned spaces are restricted to areas which need to be mechanically ventilated whatever their location, for example dirty utilities and transiently-occupied space such as stores, corridors etc.

Energy management and good housekeeping

4.24 Good energy management practices must be put in place to ensure that energy is being used effectively and efficiently. Designing in the appropriate monitoring and control functions will enable energy to be managed properly by the staff once the hospital has been handed over.

5.0 Elemental breakdown of energy consumption and energy-saving measures

5.1 More than half of the energy consumed is for the provision of environmental services such as heating, lighting and ventilation. The remainder is used for functional services such as catering or hot water and sterilization. Energy savings can be made in both the environmental and functional services through good design.

Ventilation and air-conditioning

5.2 **Air treatment is the largest single energy user in a hospital**. It can account for up to 46% of the total energy consumed (air heating, fan power and humidification).

5.3 Mechanical ventilation is necessary in a hospital to maintain a comfortable level of fresh air, and to control pollutants. However, there are many ways to improve the efficiency of the air treatment system:

- in an energy-efficient hospital, heat recovery from exhaust air can reduce the overall consumption by as much as 15%;
- correct zoning will ensure that ventilation supply is tailored to the needs of each area; zones with similar demand patterns can be fed from the same air-handling unit. 24-hour and 9–5 areas should be kept separate;
- recirculation reduces energy consumption and can be adopted in non-clinical areas.

5.4 The interaction between the heating system and the ventilation system should be taken into account when designing the systems and controls. Overheating can occur in mechanically ventilated areas if this is not clear.

Space heating

5.5 Space heating accounts for about 13% of total energy consumption.

5.6 Good central and local control will give substantial scope for further energy savings and help to provide a comfortable environment:

- 9–5 areas should be segregated from 24-hour spaces so that they can be controlled independently. For example, turning off the heating in areas that are only intermittently occupied should not affect continuously occupied areas;
- individual room temperatures can be controlled by thermostatic radiator valves;
- temperatures should be automatically reduced at night in unoccupied areas;
- heat losses can be minimised in distribution by insulating pipework and avoiding long runs of hot water pipes;
- consumption of electricity for pumping can be reduced by the use of low-loss motors with variable speed control;
- automatic doors at entrances avoid cold draughts and reduce heat losses.

Domestic hot water

5.7 Hot water can account for more than 12% of the energy consumption of a typical 300-bed hospital.

5.8 Energy consumption can be minimised by:

a. careful design of pipework sizing and layout, and applying high standards of thermal insulation in the pipe distribution system;

b. provision of local water heaters in areas of low demand;

c. use of low flow-rate taps wherever possible;

d. use of variable speed control of distribution pumps to reduce electricity consumption as demand drops.

Reducing consumption of hot water will save on water costs as well as energy.

Catering

5.9 Design of an energy-efficient catering function can reduce the energy requirement per meal by 70%.

5.10 There is substantial scope for reductions in costs by giving attention to:

a. better insulated equipment;

b. more efficient food processing equipment, for example combi cookers, high-speed steamers;

c. equipment with integral heat recovery devices, for example dishwashers;

d. designing in a monitoring and control system.

5.11 Very often, equipment is left switched on unnecessarily. This can be avoided by good housekeeping and time-switch control to banks of equipment.

Lighting

5.12 Fluorescent lamps use 80% less energy than equivalent tungsten lamps and last eight times as long.

5.13 Lighting accounts for 10% of the energy consumption of a typical hospital, but can be 20% of the energy cost. Energy consumption can be minimised using:

a. compact fluorescent lamps for task lighting, bedhead lamps, and elsewhere in preference to tungsten light sources;

b. slimline T8 polyphosphor tubes in other areas; these combine good colour rendering with high efficiency;

c. low-loss control gear to reduce fluorescent tube switching losses by up to 66%;

d. light fittings with high-efficiency reflectors which give out a greater output of light.

5.14 A good control system will produce substantial savings. Lighting is required at different intensities and at different times of the day in different areas. The lighting system should be zoned so that each area can be controlled separately. Care should be taken to group lights and switching circuits to match the requirements of the area. For example, it should be possible to switch off lights near windows while keeping interior lights on.

5.15 Energy wastage through misuse of artificial lighting is a common occurrence. Lights are left switched on at times when there is an adequate level of daylight. Sometimes, too, lights are left switched on in unoccupied spaces. This wastage can be minimised by the installation of automatic light control systems.

Refrigeration

5.16 Refrigeration is mainly used to provide chilled air for air-conditioning. It accounts for around 2% of the site's energy use. Despite this low proportion, substantial energy savings can be made through the following measures:

a. reduction of cooling load by good control and correct zoning of the air-conditioning system;

b. use of variable-speed control of circulating pumps.

Humidification

5.17 Humidification for the supply air should be restricted to the specific spaces where humidity control is needed; this includes operating theatres and ITU wards and respiratory care accommodation. Steam used for humidification should be generated locally; this obviates the need for central plant and distribution mains.

Cold water

5.18 The cold water supply uses very little energy if it can be stored in high-level cisterns using mains pressure. Where pumps are needed, the energy demand can be reduced by the use of variable-speed control.

Energy-efficient process design

5.19 Steam required for sterilization should be generated locally rather than centrally.

Other areas

5.20 Energy is also used for areas such as transport, pumping, electric motors, electric equipment etc. The following general principles should be followed:

a. select equipment appropriate to the requirements – oversizing of motors, fans, pipes etc is a major cause of wastage;

b. specify energy-efficient equipment such as low-loss motors or pumps. These are slightly more expensive initially but are generally cost-effective;

c. ensure that equipment can be correctly controlled and switched off when not in use.

6.0 Selection of energy sources

6.1 The choice of the right combination of energy sources is critical to the functionality and economic operation of a hospital. **Each source selected has to be economically justified over the anticipated life of the hospital.** There is a range of factors affecting selection:

- present and future availability;
- practical use on site;
- delivery;
- storage;
- disposal of combustion waste;
- environmental impact;
- cost of fuel;
- capital cost of equipment;
- efficiency over operating period;
- flexibility to cope with growth/change of use;
- revenue costs.

All these factors should be considered by the design team in developing the site energy strategy. The key points relating to each of the main energy sources can be found in Encode 2.

6.2 The tariff structure of all energy sources is subject to change, particularly for those sources which apply to natural gas and electricity. The key points on purchase of each energy source can be found in Encode 2.

6.3 To prepare an energy-efficient design which is also cost-effective, **the consideration of tariffs is critical**. The design team needs to:

a. obtain detailed information on the tariff structure for all potential energy sources;

b. make an accurate assessment of demand profiles for heat and power usage spent throughout the year;

c. undertake detailed analysis to determine the optimum tariff selection.

Natural resources

6.4 When considering natural resources of heat and power for a new hospital it is unlikely that any will be economically viable. Investment in other energy-saving measures will give a better return.

7.0 Finance

7.1 One of the objectives of aiming for higher energy efficiency in hospitals is to reduce costs, and do so cost-effectively. Some reduction in consumption can be achieved at no extra cost simply by adopting a few of the principles outlined in this document. However, in order to achieve more significant savings and plan for the future, extra capital expenditure will be needed. Investing in energy-saving measures makes economic and environmental sense and **a sum equivalent to 2½% of project works costs is considered to be an appropriate level of investment**.

7.2 It is important that all options are evaluated to ensure that the options selected provide value for money. This evaluation forms part of the business case and should include an analysis of the risk associated with each option.

Assessment of cost-effectiveness

7.3 The method used to determine whether or not a particular measure is cost-effective – that is, whether or not it should be included in the design – is the calculation of the benefit-to-cost ratio. Table 1 shows an example of a typical calculation.

7.4 This ranking is also useful in determining which energy-saving measures to adopt, since not all measures which are shown to be cost-effective are likely to be affordable.

8.0 Conclusions

8.1 The main considerations in achieving energy efficiency in new hospitals are outlined below; these can be regarded as forming a checklist:

- energy efficiency must be incorporated into the planning stage of a new healthcare facility and remain a significant consideration throughout the design and subsequent operation;
- expenditure of 2.5% of total project works cost should be allocated to cost-effective energy-saving measures;
- the effect of the shape, mass and orientation of the building on the consumption of energy must be taken into account;
- air infiltration should be limited to less than 0.5 air changes/hour;
- building management systems must be incorporated into the design of all services;
- design of ventilation and air-conditioning systems should incorporate heat recovery, zoning, recirculation in non-clinical areas and variable-speed control of fans;
- design of space heating systems should incorporate central and local control of time and temperature, zoning, variable-speed control of pumps and minimisation of losses via decentralisation;
- design of domestic hot water systems should minimise the risk of legionella infection while also minimising losses via decentralisation and incorporating low flow-rate taps, variable-speed control of distribution pumps, and accurate time and temperature control;
- design of lighting should incorporate high-efficiency luminaires, including controls enabling zoning and automatic switching;
- design of refrigeration should incorporate accurate time and temperature control, variable-speed control of coolant pumps, and instrumentation to enable detailed monitoring of conditions;
- design of cold water systems should incorporate variable-speed control of pumps;
- each energy source selected must be economically justified over the anticipated life of the hospital;
- to determine appropriate tariffs, detailed information on the tariff structures and demand profiles must be analysed in detail;
- a detailed site energy strategy must be developed to determine the most cost-effective way to supply the hospital energy demands;
- benefit-to-cost ratio analyses must be undertaken to determine whether or not energy-saving measures are cost-effective.

Example – wind turbine, Wansbeck Hospital		
a.	Works cost and fees	£69,400
b.	Works cost and fees Present value	£59,300
c.	Fuel saving	(£129,449)
d.	Revenue costs (excluding fuel) Present value	£28,300
e.	Net savings Present value ((c) – (d))	£101,149
f.	Benefit/cost ratio ((e)/(b))	1.71

Table 1 Benefit-to-cost ratio calculation

Bibliography

NHS Estates publications

Low energy hospitals: St Mary's Hospital, Isle of Wight: 1st year appraisal. NHS Estates, Department of Health, 1994.

Health Technical Memoranda (HTMs)

Abatement of electrical interference. (HTM 2014):

Management policy. NHS Estates, HMSO 1993. ISBN 011321670X

Design considerations. NHS Estates, HMSO 1993. ISBN 0113216718

Operational management. NHS Estates, HMSO 1993. ISBN 0113216734

Validation and verification. NHS Estates, HMSO 1993. ISBN 0113216726

Ventilation for healthcare premises (HTM 2025). NHS Estates, HMSO, 1994.

Hot and cold water supply, storage and mains distribution (HTM 2027). NHS Estates (in preparation)

Strategic Guides

A strategic guide to combined heat and power for General Managers and Chief Executives. NHS Estates, 1991.

A strategic guide to energy management for General Managers and Chief Executives. NHS Estates, 1994.

A strategic guide to environmental policy for General Managers and Chief Executives. NHS Estates, 1992.

Building Research Establishment publications

Good Practice Case Studies (GPCS)

Energy efficiency in hospitals: condensing gas boilers for heating and hot water (GPCS 40). Building Research Establishment, Energy Conservation Unit (BRECSU), 1993.

Energy efficiency in hospitals (GPCS 129). Building Research Establishment, Energy Conservation Unit (BRECSU), 1992.

Reducing electricity consumption and costs in hospitals (GPCS 130). Building Research Establishment, Energy Conservation Unit (BRECSU), 1993.

Good Practice Guides (GPG)

Energy audit and survey guide for building managers and engineers (GPG 28). Building Research Establishment, Energy Conservation Unit (BRECSU), 1991.

Reduction of energy waste in hospitals by good housekeeping: guide for financial managers (GPG 51). Building Research Establishment, Energy Conservation Unit (BRECSU), 1992.

Good housekeeping in the NHS: a guide for energy and estate managers (GPG 52). Building Research Establishment, Energy Conservation Unit (BRECSU), 1993.

Electricity savings in hospitals: guide for senior financial managers (GPG 53). Building Research Establishment, Energy Conservation Unit (BRECSU), 1993.

Electricity savings in hospitals: guide for energy and estate managers (GPG 54). Building Research Establishment, Energy Conservation Unit (BRECSU), 1993.

Selecting air-conditioning systems: a guide for building clients and their advisors (GPG 71). Building Research Establishment, Energy Conservation Unit (BRECSU), 1993.

Energy Efficiency Office publications

Economic use of electricity in industry (Fuel efficiency booklet no 9a). Energy Efficiency Office, 1993.

Economic use of electricity in buildings (Fuel efficiency booklet no 9b). Energy Efficiency Office, 1993.

Controls and energy savings (Fuel efficiency booklet no 10). Energy Efficiency Office, 1993.

Energy management and good lighting practices (Fuel efficiency booklet no 12). Energy Efficiency Office, 1993.

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